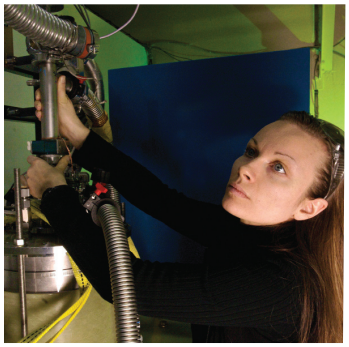
NHMFL-PFF

National High Magnetic Field Laboratory Pulsed Field Facility

Los Alamos National Laboratory is home to the National High Magnetic Field Laboratory-Pulsed Field Facility (NHMFL-PFF), one of three campuses of the NHMFL, the nation's premier institution for high magnetic field science.

NHMFL-PFF specializes in the highest magnetic field intensity research magnets and science in transient or "pulsed" fields and has the world's only research program that has delivered scientific results in non-destructive magnetic fields up to and exceeding 100 tesla. It operates an international users program for research in high magnetic fields.

NHMFL-PFF's charge to the Laboratory is to make available the highest magnetic fields for scientific research and to develop the related technologies to advance high field magnet science for the future. The NHMFL is sponsored primarily by the National Science Foundation, Division of Materials Research, with additional support from the State of Florida and the US Department of Energy.



Sonja Francoul (former PD) adjusts a He-3 fridge on a 65 tesla pulsed magnet.

Capabilities

Magnetic fields are a key tuning parameter in experimental sciences, particularly in condensed matter physics. Experiments in fields approaching 100 T performed at Los Alamos have enabled some of the first measurements to be made in high temperature superconductors of the microscopic quantum properties of the normal electrons, fundamentally changing our understanding of the role of strong correlations between electrons.

At the NHMFL-PFF, immense electrical currents are switched into electromagnets to create extreme magnetic fields and then controllably shut off before the gigantic electromagnetic forces and temperatures vaporize the magnets. By using this transient

approach, magnetic fields can be generated more than two times greater than what is possible in static electro-magnets. Los Alamos has a well-established competency in experimentation in transient systems and developing state-of-the-art diagnostics in extreme conditions.

Facilities

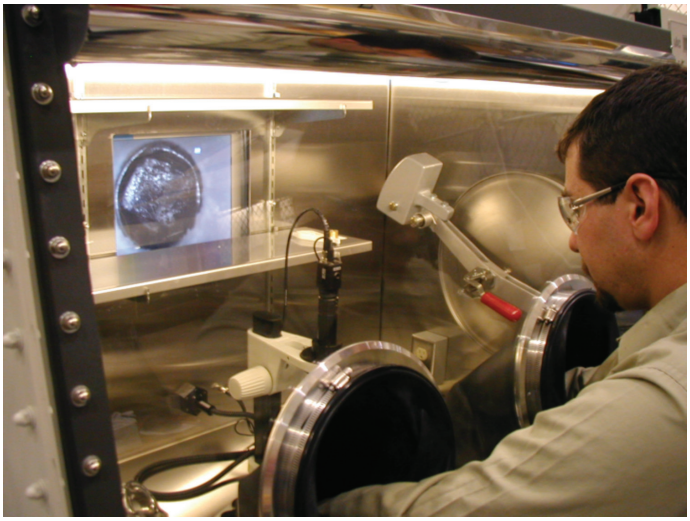
At the heart of the world-record-setting 100 tesla magnet system is the NHMFL-PFF's 1.43 billion watt generator system, which is capable of delivering a pulse of electrical energy of 170 million

Joules (the energy equivalent to about 85 sticks of dynamite). As well, capacitor banks power a wide range of magnets–about a dozen–from the "workhorse" 65 tesla user magnets to the extreme 300 tesla semi-destructive "single-turn" magnet used to study actinides in extreme high magnetic fields

As well, the NHMFL-PFF is equipped with facilities for magnet fabrication, maintenance, and analysis; has access to material development and characterization laboratories; and employs computer simulations to develop pulsed magnets with specialized capabilities for unique experiments.

Science

The discovery science associated with fundamental electronic structure determination is a particular area of exceptional expertise at the Los Alamos National Laboratory campus of the NHMFL. Hundreds of new materials, ranging from superconductors to organic-based magnets, arrive at the NHMFL-PFF to unlock the fundamental physics behind the material functionality.



A researcher prepares a $PuCoGa_5$ sample in a glovebox prior to a high magnetic field measurement of the superconducting properties.

User Program

The NHMFL-PFF pulsed magnets and experimental capabilities are unique in the world and the ability to produce cutting-edge science is a major attraction for Los Alamos visitors. The NHMFL-PFF's international users program is funded by the National Science Foundation (NSF) and is open to all scientifically qualified users from universities, industrial laboratories and other research laboratories throughout the world.

For more information about the NHMFL-PFF, its capabilities, and its user program, please visit www.lanl.gov/orgs/mpa/nhmfl/index.shtml.